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SHEPHERD I. FRANZ, GOVT. HOSP. FOR INSANE

HOWARD C. WARREN, PRINCETON UNIVERSITY (*Review*)

JOHN B. WATSON, JOHNS HOPKINS UNIVERSITY (*J. of Exp. Psych.*)

JAMES R. ANGELL, UNIVERSITY OF CHICAGO (*Monographs*) AND

MADISON BENTLEY, UNIVERSITY OF ILLINOIS (*Index*)

WITH THE CO-OPERATION OF

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THE  
PSYCHOLOGICAL BULLETIN

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GENERAL REVIEWS AND SUMMARIES

MEMORY, IMAGINATION, LEARNING, AND THE  
HIGHER INTELLECTUAL PROCESSES  
(EXPERIMENTAL)

BY PROFESSOR J. W. BAIRD<sup>1</sup>

*Clark University*

I. MEMORY AND IMAGINATION

(a) *Discussions of General Questions.*—Müller-Freienfels (38) points out that investigators of memory have almost invariably employed a procedure which consisted in memorizing intellectual materials, and hence their findings have not done justice to the affective aspects. One's remembrance of Venice or of a snake contains affective components which are no less significant and no less essential than the intellectual components; memory is made up for the most part of feelings, and in many cases of remembering no reproduction of sensory content takes place. The affective and volitional factors play an important rôle in that they increase excitability, they contribute to an orderly arrangement of contents, and they bring it about that the individual shall have these contents at his disposal for definite purposes. The author differentiates three sorts of memory: *Orienting memory*—which manifests itself not in a reproducing of intellectual contents from past experience but in certain attitudes (attitudes of being known, of being familiar, of being different and the like); these affective and attitudinal contents serve as cues to orientation—that is, they enable me to take up an attitude toward things and men when I encounter them a second

<sup>1</sup> The writer is indebted for aid in the preparation of this paper to Professor Samuel W. Fernberger of Clark University.

time, although I may have no sensory remembrance of my previous experience with them. *Reproductive memory* consists in the reproducing of sensory and motor data from past experience. *Productive memory* makes use of these reproduced data but its function is one of free combining of the data; the difference between productive memory and creative imagination is a difference only in the "direction of the reconstruction" in the two cases—a differentiation which is not made clear by the author. These three sorts of memory represent three genetic stages, orienting memory being the primitive stage and productive memory representing the highest stage of memorial evolution. In a discussion of organic memory Dugas (18) identifies this function with motor memory, and regards it as an intermediate between "psychological memory" and the merely mnemonic survival of certain physical and chemical effects. Organic memory has much in common with habit—indeed, habit is only a special form of memory; but in certain regards organic memory resembles "psychological memory"—an essential difference, however, consisting in the fact that while the one is a remembrance of acts the other is a remembrance of ideas. Adopting Maine de Biran's differentiation between mechanical, sensitive and representative memory, one would say that organic memory is a mechanical memory which may be sensitive but can never be representative. The function of organic memory differs from that of representative memory; and notwithstanding certain resemblances these two forms of memory differ both in their origin and in their nature. Organic memory originates in trials and gropings; it is irrational and blind; it does not proceed by reflection or reasoning; it is accompanied by feelings of a specific sort, but is not accompanied by ideas or images.

In a paper on extraordinary memories, subnormal and supra-normal, Dugas (19) cites numerous illustrations (idiots, mathematical prodigies) to show that extraordinary memories differ not in nature but only in degree from normal memories; they are variants in the direction of enlargement or diminution but not in the direction of transformation. They may all be explained from the laws of normal memorial functioning, and they in turn throw light upon these laws. While supra-normal memories always presuppose a high degree of fundamental endowment (natural retentiveness) they show that understanding is an invaluable aid to memory. In his study of chess-players Binet has demonstrated that the most marvelous memories are those which have recourse to reasoning and the relations of ideas; and Dugas reaches a similar conclusion



—namely, that the most efficient supranormal memory is only a good natural memory which has been raised to maximum efficiency by superior organization.

(b) *Imagery*.—Weber (51, 52) alleges that the imaginal content of day-dreams is dominantly auditory while sleep-dreams are characterized by a predominance of visual content; and he confirms this statement by illustrations from mental pathology which show that hallucinations tend to be auditory by day but visual at night. This remarkable alternation of modality is traced to the following source: At the time when primitive man was in danger of being attacked by nocturnal enemies, it was essential that he should "post a sentinel"; and since the sentinel must be independent of illumination, this duty devolved upon the sense of hearing. In consequence of this state of affairs it became expedient that the operation of auditory imagery (auditory hallucination) should be reduced to a minimum during the night in order that auditory perception should then attain maximal efficiency. Miss Gordon (23) reports an investigation of mental imagery in which Miss Fernald's spelling-test was employed. Words were presented in auditory fashion to five adults and twenty-five children who attempted to spell them backwards, and who afterwards described their procedure. It turned out that certain observers employed complete visual images (global images of the whole word), others employed fragmentary visual images (of but a single syllable at a time), while others had recourse to auditory and articulatory images. The employment of the global visual image proved to be the most advantageous procedure, those individuals who employed fragmentary visual images being no more efficient than the non-visualizers. Miss Martin (31) advocates the view that whether one shall see ghosts or not depends upon whether or not one tends, especially when under the stimulation of emotion, to project one's visual images into space; and this view she supports by citing evidence obtained from three students. When visual images are projected under laboratory conditions they do not possess the "reality" of apparitions; the image must have an emotional accompaniment which marks it off from other projected visual images. (See also Aveling, Lunniss, Moore.)

(c) *Association and Inhibition*.—Wohlgemuth's investigation (55) was undertaken for the purpose of deciding between the claims of the rival theories of simultaneous and successive association—that is, between those theorists who hold that mental contents

must be present simultaneously if an association is to be established between them, and those who hold that in consequence of the narrow range of consciousness we can not attend to two contents simultaneously, and hence successive presence in consciousness must suffice for the establishing of associations. Wohlgemuth's experiments consisted essentially in presenting colors and forms in paired arrangement, varying the conditions in such fashion that the two members of the pair were exposed simultaneously in certain cases, successively in other cases; and in instructing his learners that the two members of a pair were to be attended to simultaneously in certain instances, successively in other instances. The effect of the learning was measured by a combined correct-associate method and recognition method. It was found that simultaneous presentation gave rise to slightly more efficient recognition (about 8 per cent.) than successive presentation, but the recognition-time was identical in the two cases. The variation in instructions was attended by less equivocal results; here simultaneous attending proved to be much more effective than successive attending. The author concludes that all associations are due to simultaneity.

Hollingworth (25) investigated the relation between articulation-time and association-time. Is it true that pure association-time is constant, and that only the time required for articulating the reaction-word varies from individual to individual? The method consisted in first determining the association-time for nineteen reagents (naming of colors, naming of opposites) and then in determining the time required by each reagent for reading all of the names of colors and names of opposites which he had articulated in the preceding association-reactions. It was found that while there is a fairly high correlation between reading-time and association-time, the latter is about twice as long throughout as the former. It is apparent that a considerable time is required for the process of association itself, that individuals vary widely in rapidity of association, and that women are probably more rapid than men.

It has been reported that when in the association-reaction a list of stimulus-words is re-presented the reagent responds, in a surprisingly large number of cases, with the same reaction-word as in the earlier sitting. Claparède (12) investigated this phenomenon by the following method: He presented stimulus-words and instructed his reagents to respond with the first associated word; in another experiment he presented pairs of logically related words and instructed his reagents to write the second word of each pair.

In a subsequent experiment in association-reaction the first members of these logically related pairs served as his stimulus-words; and in yet another experiment in association-reaction he re-presented the stimulus-words which had been presented in the first experiment. The interval between presentation and re-presentation varied from one minute to one week. The results show that "created associations" are much more permanent than "presented associations,"—that is, the associated words which had been supplied by the reagent himself were much more frequently reproduced in the re-presentation sittings than the associated words which had been furnished by the experimenter. Claparède concludes that this phenomenon is not due to the greater mental activity involved in the case of the created associations; he fails to find a satisfactory explanation. A qualitative analysis of association-reactions (one hundred and thirty defective children, with two hundred normal children as a control) leads Miss Otis (40) to differentiate five types of response: Repetition of stimulus-word; non-logical associations; phonetic associations; poly-verbal associations; uni-verbal associations. These various types she describes in detail, pointing out certain characteristic differences between normal and abnormal children. Crane's investigation of the association-test (13) convinces him that this test is not a reliable means of disclosing the presence of guilty knowledge. The association-reaction is lengthened by various factors: Certain verbal forms of stimulus-word; the advent of visual imagery; the presence of competing association tendencies; momentary absence of association tendencies; emotion; volitional inhibition of association tendency. Miss Wilson's investigation (54) of controlled association is essentially a repetition of Watt's experiments—the six tasks consisting in finding a reaction-word which would be coördinate, superordinate, subordinate, etc. The introspections of her four reagents are so jejune and so unanalyzed as to leave the reader wholly in doubt as to what really was present in consciousness. In an introspective investigation of the free association-reaction Roels (43) found that a process of consciously searching for a reaction-word is present in about one third of the cases. (In one of the four reagents this searching process occurred in about sixty per cent. of the cases—a difference which the author refers to a difference of *Einstellung*.) Among the factors which direct the searching, consciousness of relation is most frequent; other determining factors—such as imagery, "sphere of reference," mechanical factors and the like—may,

however, play a more important rôle in certain reagents. The process of searching may appear at different stages of the reaction-consciousness; it may manifest itself at the first instant of the experience, in consequence of a specific attitude of the reagent, but it usually does not make its appearance until later. The efficacy of the searching varies widely from individual to individual; searching usually lengthens reaction-time, but in cases where the searching is directed by imagery it accelerates the reaction.

In a study of retroactive inhibition DeCamp (16) presented lists of nonsense-syllables followed by intervals of rest or of work (mental multiplication) or by various distributions of rest and work. An examination of the number of *Treffer* and of the *Treffer*-times in the various cases leads the author to the conclusion that it is exceedingly doubtful whether retroactive inhibition plays any significant part in influencing the recall of nonsense-syllables. He found no positive introspective evidence of the existence of retroactive inhibition nor did his inexperienced learners furnish any evidence of it. DeCamp advocates the view that retroactive inhibition may be present when identical or partially identical groups of neurones are involved in the learning of the syllables and in the subsequent mental work.

(d) *Recognition*.—In an investigation of the differences between recall and recognition Miss Mulhall (37) employed three procedures: Pictures of objects, geometrical forms, words and nonsense-syllables were presented and re-presented until her learners were able to recognize them and to recall them without error; she also presented nonsense-syllables and photographs, in one case instructing her observers to determine to remember them, in another case without determination—and in both cases she subsequently tested recall and recognition; she presented nonsense-syllables and photographs in an invariable order—with a view to discovering the influence of primacy and recency upon recall and recognition. It was found that the difference in the number of repetitions required to insure recall and to insure recognition was greatest in the case of pictures, less in the case of forms and words, and least in the case of nonsense-syllables—from which the author concludes that the difference between recall and recognition seems to depend in part upon the richness of associations present; intent to remember has an influence upon recall but little or no influence upon recognition, this influence being greater in the case of names than in the case of nonsense-syllables; the factors of primacy and recency have a greater influence upon recall than upon recognition, and a greater

influence in the case of significant materials than in the case of non-significant materials. In an investigation of the influence of localization upon recognition Viqueira (49) presented lists of sixteen nonsense-syllables arranged in the form of a square. The recognition-test—after an interval of nine minutes—consisted in presenting a similar square containing four new syllables and twelve old syllables, some of the latter occupying their original positions and some occupying new positions. Results obtained from nine observers show that a syllable is recognized more readily and more correctly when it occupies its original position. Fischer (22) returns to the question as to whether the process of recognizing does not demand the presence of a reproduction-tendency. His materials consisted of variously different groups of dots and he attempted to answer two definite questions: Is recognition-time shorter when the reproduction of the object to be recognized is facilitated in advance? Does rapidity of recognizing result in an impairment of accuracy? His results show that the former question is to be answered in the affirmative, the latter in the negative—from which he concludes that “a slight degree of subliminal reproduction seems to be necessary for immediate recognition; at any rate it certainly aids immediate recognition.”

Feingold (20) first attempts to quantify the degrees of similarity of certain stimuli (words, colored postcards), and then he employs these stimuli in an endeavor to determine what is the relation between degree of similarity and degree of cognitive ability. His objective results are formulated as laws of recognition: Cognitive ability decreases with increase of similarity; cognitive ability varies inversely as the number of objects exposed when the exposure-time is the same for each object and is not longer than one second; cognitive ability varies with exposure-time, the number of objects being constant. The introspections show that the recognition of dissimilarity results from the fact that the dissimilar stimulus arouses a shock of strangeness, a different mood, or a different kinæsthesia; or results from the fact that the dissimilar stimulus fails to fit in with the memory-image of the former stimulus. The perception of a similar card tends to evoke a generalized image of its mate; the author believes, however, that imagery plays only a secondary rôle in recognition. He concludes that “the process of recognition is affective and is independent of cognition,” although he mentions the fact that “most cases of false recognition are due to the obliteration of the original impression by the present per-



ception." In Miss Fildes's study of recognition (21) incomplete and unusual pictures of familiar objects were presented visually, and familiar objects were presented tactually—the observer being assigned the task of recognizing them and describing his experience. It was found that the most frequent contents of the recognitive consciousness were kinæsthetic sensations from eye-movements, images, attitudes or feelings, and "thoughts." The author concludes that the sensations and images play no essential rôle in the process of recognizing; she failed to determine what is the rôle of the attitudes or feelings.

In Owen's experiments (41) stimuli—colors, letters, numbers, geometrical forms, or nonsense-syllables,—were presented in pairs. Then after an hour's interval one member of the original pair was re-presented either in combination with a stimulus chosen from another pair of the original series, or in combination with a wholly novel stimulus. The observer was asked to report and describe his recognitive experience in each case, *i. e.*, he was asked to determine whether the present stimuli had been presented previously, whether they had been presented together, whether they had been presented together in the present order. Notwithstanding wide individual variations it was found that observers are more likely to recognize that old stimuli are old than to detect that new stimuli are new. Among the factors which seem to contribute to recognition are the behavior of visual imagery (stability, localizedness, promptness of advent), certain kinæsthetic experiences, and certain associative characteristics; neither specific organic sensations nor typical moods nor characteristic behavior of attention seem to play a significant rôle in the process of recognizing. The author differentiates and describes five classes of recognitive judgment; and he devotes additional experiments to an investigation of recognition-time, "selective" recognition, recognition of voluntarily recalled materials, the rôle of congruity of context, and the differentiae of memorial and imaginal images. Miss Woods (56) undertook to analyze the process of recognizing. She chose stimuli which would appeal to various sense-modalities—musical compositions, the alphabet of the blind, odors, and several variants of letter-form (faces of type); and her method consisted in presenting and re-presenting these unfamiliar stimuli in successive sittings until her observers became familiar with them. She obtained an introspective description of each process of recognizing; and a comparison of her successive cross-sections through the recognitive consciousness

enabled her to analyze the process and to trace out such variations in its form and content as occurred with progressive increase of familiarity. The process of recognizing was found to be essentially similar for the various sorts of stimulus material and to be characterized throughout by the presence of kinæsthetic and organic components. The recognizing of relatively unfamiliar stimuli differs from the recognizing of familiar stimuli in that the former is attended by a wealth of definite and detailed imagery while the imaginal content of the latter is either sparse and fragmentary or is wholly lacking (save for the motor or organic components which never fail to appear). Affective toning is not an invariable constituent of recognition at any of its developmental stages. The process of recognizing was attended throughout by a characteristic behavior of attention; this consisted in the dominating of a recognition-*Aufgabe* in consequence of which attention moved in a given sequence from perception through appropriate reaction to subsequent relaxation—more or less definite activities of comparing and contrasting being present in the earlier developmental stages of the process (relatively unfamiliar stimuli). Recognition is a sequential experience which may be analyzed into components; it is an on-going consciousness of activities, of pauses, of adjustments of attention; and its *sine qua non* is an orderly procession of mental events which proceeds from perception through appropriate reaction to final shift of attention, this procession being under the direction of a specific *Aufgabe* or *Einstellung*. A. L. D. (14) advocates the view that certain cases of false recognition may be explained from the fact that the contents of dreams or of actual experiences may still survive in such dim and diffuse form that they are imperceptible, although they may serve to arouse a process of recognition.

(e) *Learning, Remembering, Forgetting*.—In an investigation of the influence of articulation upon memorizing Zucarri (57) employed ten learners of different age, sex, and degree of education. Selections of prose and poetry were learned under natural conditions and under conditions where articulation was inhibited by counting aloud. It was found that memorizing was impaired by the inhibition of articulation—memorizing without articulation requiring on the average about seventy per cent. more time than memorizing with articulation; and a subsidiary experiment indicates that the impairment was due not to distraction of attention but to the non-participation of articulation. An experiment by Misses Mould,

Treadwell and Washburn (36) consisted in memorizing nonsense-syllables in various fashions—with and without intervals between successive presentations, and by learning-methods in which articulation was emphasized, was voluntarily inhibited, and was inhibited by distraction. The results obtained from one hundred and forty-four learners show that distributed repetitions are more efficacious throughout than accumulated repetitions; and since this advantage is much greater in cases where articulatory processes are emphasized the authors conclude that Jost's law is primarily a law of motor learning. In an investigation of the effect of rhythm upon learning Adams (1) read lists of digits to his classes (one hundred and eighty learners) and tested the learning by immediate recall. The rhythms which he employed in presenting the digits were trochaic, iambic, dactylic, amphibracic, and anapæstic, together with a non-rhythmic presentation. It was found that while rhythmic presentation is in general superior to non-rhythmic, yet trochaic presentation is sometimes inferior to non-rhythmic presentation; dactylic presentation proved to be most advantageous for men and anapæstic presentation for women. Adams (2) attempted to determine the relative value of a full-page advertisement presented once, a half-page advertisement presented twice, a quarter-page advertisement presented four times, and an eighth-page advertisement presented eight times; one hundred men and one hundred women served as subjects in the experiment and the values were determined by a method of immediate recall. The results show that the highest memorial value attaches to the eight presentations of the eighth-page and the lowest memorial value to the four presentations of the quarter-page. In an investigation of the effect of obstructed breathing upon learning Arnold (3) in one case plugged the nostrils of his learners in such fashion as to obstruct breathing, and in another case inserted a hollow plug in such fashion as to provide an equal distraction of attention without obstructing respiration. Groups of letters or digits were memorized under these two conditions, and retention was tested by immediate recall. It was found that obstructed breathing results in a loss of from ten to thirty per cent. of the learning effect.

In his memorizing of lists of digits Ruckle reached the conclusion that his learning-time varies with the square of the number of digits in the series. Schultze (44) finds that this law holds for longer lists (containing more than one hundred and forty-four digits), the deviation becoming greater the shorter the list. This circumstance

indicates the existence of a second law whose operation is especially effective in the learning of shorter lists; and further investigation shows that the total time for learning any list is a composite product of the number of groups made by the learner in his memorizing, of the number of readings required, and of the average duration of the particular readings. Schultze's formula enables him to calculate learning-times with an average deviation of 3.5 per cent.; and he raises the question as to whether we are not here concerned with a general law of human work. Lambrecht (28) presented nonsense-syllables and colored forms to twenty-one learners; and the procedure was such that any given form was presented in the same color throughout in certain cases but in a different color at each presentation in other cases; in the recognition-test which followed after twenty-four hours the form was presented either in the color which it had possessed throughout the original presentations or in a color which it had never possessed in the original presentations. The results show that it is not possible to ignore color and learn form alone; if the form presented in the recognition-test possesses a "new color" it is more likely to be recognized in cases where its color was constant throughout the original presentations; when a form is associated with a syllable the former will more likely reproduce the latter in cases where it bore the same color throughout; when a syllable is to be associated with a given form the association is stronger when the color of the form remains constant throughout the presentations than when it is varied.

Since the independent function of each of the several factors which cooperate in the act of learning has never been fully investigated, Michotte and Franzen (33) undertake to isolate these factors and to investigate the isolated function of each (grouping the material; associations between adjacent members and between remote members of the series; perseverative tendencies; localizations; general physiognomy of the series; identification; memorial aids and devices of miscellaneous sorts). Their method consisted in presenting lists of nonsense-syllables and subsequently in re-presenting them in transposed order; and in devoting different numbers of repetitions to the various acts of learning—*i. e.*, in bringing the act of learning to varying levels of perfection in the various cases. They found that the re-learning of a list of syllables in transposed order required a greater number of repetitions than had been necessary for the original learning half an hour previously; and variations in their experimental arrangement enable the authors

to show that this excess of repetitions is due to the fact that the perseverative tendencies decay rapidly during the first half-hour of their existence. It was found that learning does not proceed in a constant and straightforward direction, but that different members of a series of repetitions give rise to widely different effects; this phenomenon is subject to individual variation and can not be formulated in a single general statement but it may be illustrated from the results obtained in the case of one of the learners: The first five repetitions gave rise to perseveration but contributed little to the establishing of associations; the next five repetitions served to establish and consolidate associations; the next ten repetitions resulted in identifications; and the final group of ten repetitions had a special effect upon identification and perseveration. When complete learning is followed by additional repetitions of the material (over-learning) these additional repetitions have a different effect upon the various factors of memorizing according to the attitude adopted by the learner; their chief effect, however, is upon perseveration. The chief effect of the inhibition which results from a former learning of the material in a different order consists in a period of inertia at the beginning of the act of re-learning; the inhibition also manifests itself in a less prompt recitation of the re-learned series.

Kortsen (27) prepared a questionnaire in which he asked his correspondents to describe their earliest remembrance, the remembrance which first comes to consciousness when they think of the first ten years of their life, of their seventeenth and eighteenth years, of their life at high school, of the past year, of yesterday. He received replies from sixty adults at the universities of Copenhagen and Paris and from thirty girls in Germany, nine to ten years of age. An analysis of these replies leads Kortsen to the conclusion that whether one shall remember an incident or not is determined not by any "law of interest" but by the physiological condition of the organism at the time when the incident was experienced. Chamberlain's experiments (10) aimed to determine whether immediate recall is influenced by age, sex, interest, and by isolated as opposed to grouped presentation. The materials employed were fifteen familiar objects (doll, pocket-knife, and the like) and the subjects were thirty girls and thirty boys from each of three school grades. It was found that efficiency in immediate recall improves from the third to the fifth grade but shows no improvement from the fifth to the eighth grade; objects presented in groups of three are recalled



slightly better than objects presented singly; no influence of sex or interest upon recall was revealed by these experiments. Brown (8) asked a class of one hundred and seventy-five students to recall the advertisements which they had seen recently in street-cars. An examination of their reports reveals the fact that the average person recalls most readily those items which many other persons can remember—the items in the shorter reports are not determined by individual or special conditions but are simply the items which are most readily remembered.

The purpose of Michotte and Portych's experiments (34) was to determine what is the influence of lapse of time upon the number and nature of memorial aids. Pairs of logically related words were presented; after various intervals (a few minutes, twenty-four hours, several weeks) reproduction was tested and an introspective analysis was made of the factors which had coöperated in the recall. The authors devote most of their discussion to those reproductions which were not directly initiated but were introduced by an intermediate content. The intermediates which serve to introduce the reproduced datum were found to vary in complexity—the reproduction coming about through the medium of a single intermediate in certain cases, while two or more intermediates were interpolated in other cases. Reproductions after twenty-four hours proved to be due to more complex intermediates than reproductions after a few minutes or after a week. The intermediate terms were of various constitution; the authors classify them under four heads; Reaction-words which came to consciousness but were rejected; visual images; consciousness of relation; non-relational thoughts. Rejected reaction-words are relatively infrequent in reproductions after a brief interval; they are much more frequent in reproductions after twenty-four hours and after one week. Visual images and consciousness of relation are about equally numerous throughout; non-relational thoughts are relatively frequent in delayed reproductions.

Myers's investigation (39) of the relation between affectivity and recall consisted in asking his subjects (two hundred and thirty-two pupils in normal schools, high schools and grades) to write such names of foods, animals, colors, books, musical instruments and persons as first occurred to them; and subsequently in asking them to specify those foods, animals, colors, etc., which they liked most and those which they liked least. The records show that the thing liked most on the average appears much nearer the top of the

list in random recall than the thing liked least; the percentage of disliked objects which are not included in random recall is always much higher than the percentage of liked objects which are not included; the average position of the most liked object is always above the median, while the average position of the least liked object is almost invariably below the median. Myers concludes that it is safe to infer that one tends to remember the agreeable rather than the disagreeable. Jones (26) advocates the view that all forgetting is due in part at least to repression. Psychoanalysis shows that the unconscious content of mind is enormously great, and that these unconscious complexes possess an exceedingly great assimilative capacity. In consequence of this the ramifications of associative connections throughout this unconscious mass are so far-reaching and so intricate that no one can state that a given idea has never been associated with an unpleasant complex. Moreover, mental economy demands that consciousness should not be burdened with irrelevant contents which might obtrude when concentration in another direction is essential. Why should not the existing mechanism of repression serve for this "utilitarian" repression as well as for "hedonic" repression? And why should one not suppose that all selective thinking is at bottom a product of this extended principle of repression? Miss Dawson (15) reports that a group of high-school graduates and normal-school students were unable to identify common plants and trees, or to locate important buildings in the city where they resided. Diller (17) believes that the loss of memory alleged by murderers is genuine and not feigned, and that this phenomenon is due to intense emotional disturbance. Tidyman (48) holds that Rice's investigation of efficiency in spelling is defective and inconclusive in that subjective conditions can not be revealed from an examination of purely objective conditions.

(f) *Practice and Transfer*.—Bradford (5) investigated the influence of practice, fatigue, distraction and physiological condition upon the forming of associations; his statement of his findings throws no new light upon the problem. Chapman's forty-six subjects (11) added continuously throughout ten ten-minute periods, a record being kept of the performance of each individual during each two minutes of the ten-minute period. These records show the presence of an "initial spurt"; more work was done during the initial two minutes than during any subsequent two minutes. In Thorndike's experiment (46) six hundred and seventy college students added forty-eight columns daily for seven days. When the students were

classified into groups on the basis of initial ability it was found that the practice curve of each group assumed the form of a straight line, excepting in the case of the two groups who had possessed the greatest ability at the outset. One of these two latter groups showed more practice effect than any other group, the other showed a loss instead of a gain. The author inclines to the view that the difference between his practice curves and practice curves of the traditional form may be explained from a difference in interest. In another experiment where one hundred and twenty-three students practiced multiplying numbers Thorndike (47) found that the greatest gross improvement was shown by individuals who had possessed the greatest initial ability. This finding indicates that individual differences in intellect and skill can not be explained from differences in opportunity, and that the status which an individual has attained through a given amount of practice is highly prophetic of his attainable status. In an investigation of the retention of acquired capacities Wells (53) had recourse to the tapping-test, the adding-test and the cancelling-test. Reagents who had taken part in an earlier investigation (where skill had been acquired by practice) were again available, after an interval of five and one-half years in the case of the tapping-test, and after two years in the case of the other two tests. Wells finds that the lapse of several years resulted in a loss of about one-half of the improvement in efficiency which had been acquired in thirty days' practice during the original experiments; and it turns out that the reagent who loses much in one function also tends to lose much in another function. Loss from disuse seems to be a more generalized property of the organism than gain from practice; the capacity to acquire skill may be high for certain functions and low for others, but the tendency to forget seems to be more nearly equal for the various functions.

Brown (6) practiced forty-five subjects for twelve days in naming colors and in reading names of colors from a printed list. The words were read more rapidly than the colors were named; on the last day of practice the average time required for reading a word was .29 seconds, and for naming a color .41 seconds. The effect of practice upon naming was considerably greater than its effect upon reading—26 per cent. as compared with 17 per cent.—but it seemed evident that but slight additional improvement in color naming could be expected to accrue from additional practice. Hence the author rejects the explanation which has been advanced (Cattell, Quantz) to account for one's lesser rapidity in naming colors—namely,

that this is due to the fact that one has had less practice in naming colors than in reading words. In order further to confirm his criticism of this view Brown arranged an additional experiment where the names or parts of the names of the colors were presented with the colors to be named; it was found that even under these conditions the (facilitated) naming required more time than the reading. The author advances the view that the processes involved in reading words and in naming objects are fundamentally different. In a later investigation Brown (7) undertook to determine whether the process of number-naming is subject to the same time-consuming difficulty as color-naming. He found that more time is required to name the number of a small group of dots than is required to name the corresponding word or Arabic numeral—a result which supports the view that the naming of objects is a slower process than the naming of words. In another experiment Brown (9) found that ten practice periods in arranging gray papers (fifty different brightnesses; thirty-seven reagents) into a graded series yielded no practice effect; it turned out, however, that practice in the process of selecting four specified grays from the series of fifty resulted in an average improvement in rapidity amounting to nearly 50 per cent.

Smith's experiments in pitch discrimination (45) were carried through with several hundred observers of both sexes, varying in age from nine years to maturity, and representing widely different degrees of kinship, musical education and general intelligence. It was found that instructions as to the meaning of pitch usually resulted in an improvement in discrimination, but two hundred and six members of a group of four hundred and seventy-six boys and girls showed no improvement either from instruction or from practice; most of those who did improve were individuals who had manifested poor initial ability. Practice in pitch discrimination consists in acquiring control over a special group of cognitive factors (auditory sensitivity to pitch can not be improved appreciably by practice), and in acquiring skill in listening to tones. As skill increases, non-voluntary attention rises to a higher level—it is found that strained attention results in distraction—and the conscious factors become mechanized. Certain observers discriminate chiefly in terms of attributes of the tones themselves—they attend to the sharpness or the dullness which is characteristic of different pitches; other observers depend largely upon kinæsthetic factors—they tend to reproduce the tone audibly or mentally, and to dis-

criminate in terms of kinæsthesia. In some cases imagery plays an important rôle; here the process of discriminating may be a process of comparing the stimulus with an auditory image; or visual imagery—localizations and spatial schemas—may furnish the criterion. The author describes various individual differences in form and behavior of attention.

In an investigation of transfer of training Poffenberger (42) trained four subjects (one hundred practices) in naming colors, in naming opposites, in checking numbers and in adding; the trained subjects and four or more control-subjects were tested by means of the form-naming test, the adjective-noun test, two forms of the number-checking test, and tests in subtracting, dividing, and multiplying. Transfer occurred in certain cases, interference in other cases. The author concludes that neither transfer nor interference takes place in cases where the activity practiced and the activity tested contain no identical bonds between stimulus and response; that transfer takes place in cases where identical elements are present in the two activities and where previously formed bonds are involved; and that interference takes place in cases where one activity necessitates the breaking of previously formed bonds and the forming of new bonds. Wang (50) sought to determine whether training in one sense-modality transfers to other modalities; after training his subjects (seven children; forty-eight days) in differentiating visual extents he tested them in differentiating pitches, colors, and visual extents of other magnitude. Although the trained subjects showed a marked improvement in the activity practiced (a 40 per cent. decrease in number of wrong judgments) they showed no significant improvement in the non-practiced activities. In a second experiment the training consisted in checking those words which contained two or three letters from the second half of the alphabet, and the test consisted in checking words containing two or three letters from the first half of the alphabet; a very considerable transfer took place here. In a third experiment the training consisted in checking pairs of words which contained two letters in common, and the test consisted in checking pairs of words which contained three consecutive different letters. Here again there was a transfer, and it increased in amount with increase in age of the subject—subjects of different ages being found to employ different modes of procedure in their work. The author concludes that sense-training is a misnomer; that in those activities where transfer does take place it is due to the acquisition of an efficient method of



dealing with the situation, and to an employment of that method in dealing with another similar situation; that the amount of transfer depends upon the efficiency of the method acquired. Martin (32) investigated the effect of practice in cancelling in one situation upon cancelling in other situations. His practice-subjects were thirty-six boys, eleven to thirteen years of age (with a similar group of control-subjects); and the practice extended over forty ten-minute periods. It was found that practice in cancelling English words containing both a and t resulted in a more rapid cancellation of Spanish words containing both a and t, but in a less accurate cancelling of Spanish words containing both e and s.

## II. HIGHER INTELLECTUAL PROCESSES

Aveling's paper (4) is essentially a re-statement and re-discussion of the findings obtained in his investigation of the consciousness of the universal.<sup>1</sup> The author recapitulates his view as follows: The sole contents of consciousness which are essential to thought are concepts; and these concepts constitute a class of mental contents which are not reducible to sensory elements or sensory complexes, or to affective and volitional processes. They must, therefore, be regarded as ultimate and irreducible mental elements. Without them it would be impossible to explain any cognitive process in the adult consciousness; and these cognitive processes owe their origin to no contents other than concepts. In cases where sensory elements make their appearance in connection with the concept they may as a general rule be regarded as a by-product of the concept, even when their advent modifies the subsequent course of consciousness. The only case in which the sensory content may be said to be essential to thought is the case in which the "particular" is present to consciousness. In other words, "conceptual thought" is essential to all intellection; and intellection can occur without anything else being present than "conceptual thought" or "imageless thought." In an investigation of the relation between imagery and meaning Moore (35) presented names of concrete objects, in certain cases instructing his observers to react when they understood the meaning, in other cases when a visual image of the object appeared in consciousness. It turned out that the reaction-time was considerably shorter in the former case than in the latter case

<sup>1</sup> F. Aveling, *On the Consciousness of the Universal and the Individual*. London: Macmillan & Co., 1912, pp. x-255. See also *Psychol. Bull.*, 1913, 10, 343f.; see also *Amer. J. of Psychol.*, 1913, 24, 276ff.

—that is, meaning appeared in consciousness more promptly than visual imagery; and the introspections also show that meaning seems “to be a conscious process *sui generis* distinct from [visual] imagery.” In a second experiment names of objects were presented, the observer being instructed in certain cases to react when he understood the meaning or use of the object designated by the name, and in other cases when he had a concrete kinæsthetic or visual-kinæsthetic image of the object, *i. e.*, verbal imagery was not to be taken into account. Both the objective results and the introspections indicate that meaning is independent of concrete kinæsthetic imagery. In a third experiment pictures of objects were presented and the observers were instructed in certain cases to react as soon as they understood the meaning; in other cases they were asked to react by naming the object represented by the picture. Here again the advent of meaning proved to be more prompt than the vocalizing of the name, the introspections showing that the sequence was meaning, word, reaction. The author appends a discussion of the influence of the observer’s attitude (where he holds that this factor is inadequate to explain his findings), and a discussion of the context theory of meaning. Miss Lunniss reports experiments (30) which were essentially a repetition of Bühler’s; she presented epigrams, pairs of congruous or contradictory proverbs, and passages of descriptive prose or poetry<sup>1</sup> with such inquiries as: “Is this true?” “Do you understand this?” “Is this an apt description of autumn?” and the like. Introspections obtained from three observers seem to the author to justify the following conclusions: Imagery is not essential to thought; consciousness of relation, consciousness of rule or principle, and intention or reference (Bühler’s *Gedankentypen*) are the essential components of judging and understanding; images and feelings constitute the indispensable contents of “supposal” (*Annahme*) but judging and understanding are based upon an awareness of the relation between the datum to be apprehended and some whole which has already been apprehended.

Harris (24) reports the results of an examination of fifteen thousand “judgments of number” made by three subjects during a period of two years. The subject took a handful of beans from a container and poured out, as nearly as possible, a specified number (twenty-five, fifty, one hundred or two hundred); he was permitted to make corrections but so rapidly as to preclude counting. All three sub-

<sup>1</sup> In numerous instances these passages contained one hundred and fifty words or more; and in certain cases passages of two hundred and thirty words were employed!

jects manifested the presence of a slight but significant personal equation—a tendency, common to all three subjects, to pour out too many beans. While the three subjects differed but slightly in personal equation, they differ distinctly in steadiness of judgment—two of them having a coefficient of variation amounting to 6.9 per cent. while that of the third was 8.7 per cent.

Lankes (29) investigated the intercorrelation of perseverations—his specific problem being: Is the individual who is characterized by a given degree of perseverative tendency in one function (sensory, motor or memorial) also characterized by a correspondingly high or low degree of perseverative tendency in other functions (attentional or temperamental)? As to his method, he assumed that rapidity of performance in the tapping-test furnishes an (inverse) measure of motor perseveration; that the liminal rate of rotation which obliterates flicker on a Maxwell disc furnishes a measure of sensory perseveration; that immediate reproduction of geometrical figures furnishes a measure of memorial perseveration; that ability to adapt oneself rapidly and effectively to a novel task furnishes a measure of attentional perseveration, and the like. Personal acquaintances of each observer in these experiments furnished estimates as to the persistence and perseverance of his character and personality. It turned out that there was no strong positive correlation between the tests and the estimates, although the situation is such as to indicate the presence and operation of some common factor throughout. The author concludes that the reason that his results turned out as they did is to be found in the fact that the perseveration measured by the tests is a native quality of the nervous system, while the perseveration measured by personal estimates of character and behavior is a combined product of this native quality and of the individual's own effort and will.

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## MEMORY, CONCEPT, JUDGMENT, LOGIC (THEORY)

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The republication of four essays by Dewey from the *Studies in Logical Theory* (1903) and of a number of other studies in this field by the same author, appearing in various journals and now in part rewritten, including articles on *Judgments of Practice* (3), published during the current year, with an introductory chapter written expressly for this occasion, has resulted in a volume (2) affording a comprehensive and profoundly significant view of the growth and applications of the instrumental, functional, or experimental standpoint in logical theory. The psychological phases, as Dewey points out in the Preface, are written from the behavioristic standpoint, though some of them antedate the use of that term. The fundamental conception of the book is that of the essentially temporal development of experience, with reflective inquiry, inference, or judgment, and all that it may involve, appearing and normally functioning as an intermediate and mediating phase in this development. This conception, developed in the earlier essays largely with the view of criticising the then reigning idealistic logic, is now, in the introductory chapter, directed toward the criticism of the analytic logic of the new realism, with the result that the analytic logic, like the idealistic logic, is found guilty of the fault of temporal dislocation, since it starts from those objects with which science ends. Emphasis is laid, in the concluding portion of the volume, on the recognition of inference as itself a fact, and as a fundamentally important fact, something done naturally, spontaneously, through which absent considerations become involved as part of the present situation, a mode of behaving to a given situation as involving something not given, but a mode of behavior which may be exercised ill or well, a habit from which consequences disastrous or beneficial may flow, a creative act which may bring falsity or truth into the world, and which has led to the gradual and halting development of technique, the technique of experimental science, adapted to its safeguarding, utilizing, and setting free. Perhaps the most distinctive and positive development of the doctrine is found in the chapters on the *Logic of Judgments of Practice*, in which, as Schiller has pointed out (15), inveterate ambiguities are cleared up and much new ground broken. Schiller would go to the extent of regarding

all judgments as conforming to the practical type, certainly all real, or live, judgments.

Crawford (1) has developed an instance of the use of the instrumental standpoint in logic as itself an instrument of analysis and criticism in the case of Mill's treatment of inference. Mill's logical problem is seen to be that of reconciling the associationism of the English empirical school with the procedure of modern physical science. Mill failed to harmonize inference and fact, since he unconsciously read back into facts the results of the work of inference in determining facts, so as to make inference seem to operate gratuitously on already completely determined fact. Fact and inference therefore fell apart and in trying to find a vital relation between them Mill oscillated from one to the other. "His difficulties could be removed only by recognizing the ultimate unity of inference and fact, and developing their distinction only as an instrumental function in the process of knowledge."

McClure (11) institutes a comparison between the Cartesian dualism of mechanism and teleology, matter and mind, and the dualism in Plato of perception and thinking, both of which dualisms are regarded as marking perhaps the most significant metaphysical distinction. Implications of the Platonic dualism are worked out in modern form and in expressed sympathy with Dewey's analysis in "How We Think." The distinction between perception and thinking is sought in the presence of the time element in some and not in other reactions. Reactions to the immediate we call perception; reactions to the time quality we call thinking.

Shaw (16) concludes, after an historical survey of the subject that whereas logistic furnishes truth to the other branches of mathematics in much the same way that algebra does to geometry, or geometry to algebra, it is intelligence, not logistic, which draws the conclusions of logistic. Logistic has the right to exist as an independent branch of mathematics, but it is not the overlord of the mathematical world.

Lalande (10) contends that the rules of logic are generalized habits of life, social, linguistic, etc., and that pure logic is incapable of being realized by our minds. The practical need of distinguishing between lower and higher order habits is the opportunity of a truly ideal, or normative, logic, which is not a pure in the sense of a formal logic, but an orientation, indefinitely progressive. (In this connection attention may be called to a recent translation of Frege's attack on psychological logic (6).)

Guthrie (8) points out that although the various contributors to the volume on Logic in the *Encyclopædia of the Philosophical Sciences* fall in with the development of logic away from the conception of that science as a branch of psychology, yet a disconcerting survival of obsolescent psychologism appears in the position assumed by all of the writers, with the possible exception of Couturat, that logic is still a science of thought as distinct from expression. The critic champions the view that logic is concerned neither with the science or art of thought, nor with the truth or validity of ideas, but with the structure of discourse and expression.

De Laguna (4) discusses certain logical paradoxes for the solution of which Whitehead and Russell have devised the "theory of types," and contends that they involve the unwarranted assumption of a fixed relation between dual relationships and their terms. With this rigid abstraction exorcised, the cramp of the paradox disappears. The same problem is critically discussed by Guthrie (7), but less radically. In another article, De Laguna (5), adversely critical of Russell's logical-analytic method, attributes its fundamental error to its confusion of material event with sense datum.

Jones (9) restates the theory that there exist in the mind certain inhibiting forces, which tend to exclude from consciousness all mental processes which would evoke a feeling of "unpleasantness," and discusses its bearings on problems of memory under the headings of registration, conservation, recollection, and recognition.

Doubtless it speaks well for the truthfulness to life of the unfolding drama of logic that it is not without the interludes of comedy, afforded, now, by the motley of Mercier (12, 13) and his more or less serious critics, Thomson (19), Skelton (17, 18), and Pickard-Cambridge (14).

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## VOCAL FUNCTIONS

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Few subjects of scientific research seem to be provocative of more varied and discrepant theories than stuttering. Coriat (2) considers it as a psychoneurosis to be treated by psychoanalytic methods. The attempt to repress into the unconscious certain trends of thought or emotion, usually of a sexual nature, develops the defective speech automatism. Stuttering is a defense mechanism, to hide from consciousness painful memories and undesirable thoughts, in order that they may not be betrayed in speech. All stuttering, with its hesitation, its fear, its disturbing emotions, is a kind of an association test in every day life and not a phonetic disturbance. Coriat vouchsafes no detailed clinical accounts of his cases and adduces no evidence which would appeal to a scientific reader in support of his convictions. Instead, he elaborates the theory, and applies it with a comprehensiveness which provokes the wrath of at least one reader, himself a stutterer. Solomon (10) in a vigorous reply, charges the whole Freudian school with evasion of the real issues and demands that they retrace their steps and first prove

the soundness and validity of their fundamental theories before seeking to enter new territories. In particular is he apprehensive of the disastrous consequences of applying Freud's sexual theories to stuttering children. "I cannot do otherwise than look upon this as positively anti-social. It would, it is my belief, be a glaring and rife source of danger to the community for these ideas to be spread broadcast."

At the opposite extreme from what Solomon stigmatizes as the "inflated theory" of the psychoanalysts, is the hypothesis of Browning (1) who publishes detailed clinical reports on twenty-five stutterers and twenty controls in support of his view, first announced in 1910, that stuttering is "associated at the start with large thymus, if not directly caused thereby." The thymus, which normally diminishes in size during childhood and largely disappears, was in evidence in every case of stuttering, careful percussion revealing the characteristic "thymic dulness" in the region of the sternum. In only one of the controls was this hyperthymism found, and this boy proved to be subject to some speech difficulties! Browning holds that stuttering is not primarily a disorder of the speech centers or of the central nervous system. It is not an isolated or merely functional affair, but it is always, at the start and before it becomes fixed as a habit, a symptom and part of a widespread or systemic condition. This general condition is a phase of hyperthymism or lymphatism, due to some block in the thymic area usually attributable to enlargement or persistence of the thymus. The morbid influence thus exerted on the organs of speech is characterized as an inhibitory reflex. Systemic conditions, circulatory troubles, and interference with free respiration, as well as imitation, fright, amnesia and other causes, are recognized as possible accessory influences; but hyperthymism is deemed to be the fundamental cause. Enlargement of the thyroid is more common in girls, while boys are more subject to enlargement of the thymus. This fact (which, by the way, is less clearly substantiated than most of the positions taken by this author) serves to explain the relatively small proportion of female stutterers, when coupled with the fact that the thoracic type of respiration tends to keep the female vocal apparatus free from the baneful inhibitions which a troublesome thymus might otherwise exert. Browning has used with some success local treatment of the thymus with the Roentgen ray, in addition to systemic and generic hygienic treatment.

Makuen (8), physician of wide experience in treating stutterers,



would agree with Browning that fear, autosuggestion, imitation, etc., are merely secondary factors in the etiology of stuttering; but, like Bluemel, he holds that the primary factor is aphasic. The stutterer is auditory-kinesthetic in his speech imagery. Kinesthetic controls enable him to enunciate the initial consonants, but temporary amnesia for the sound of the vowel quality interferes with correct phonation. Makuen thinks this partial auditory-motor aphasia—what he calls the primary cause—is generally congenital and hereditary. Such beneficial results as have attended the use of elocutionary methods of treatment are mainly due to the resulting improvement in the stutterer's mastery of auditory speech imagery; and these benefits have been multiplied when the training has been carried on with this purpose distinctly in view and with the attention of the patient consciously focused upon the imagery. In passing, Makuen pays his compliments to psychoanalysis which in the treatment of stuttering "has proved to be an absolute failure." He would doubtless look askance also at Freudian explanations, such as Ferenczi (5) gives, of cases where men use now the masculine and now the feminine vocal register in talking.

Evans (4) has gathered a few illustrations in support of the theory that anatomic considerations have had a share in determining which speech sounds are used to express certain ideas. For instance, in eight languages, the word "to eat" employs a dental consonant, while the word "to drink, to gulp" uses a guttural.

Pillsbury (9) indulges in a tilt at Wundt's account of the mental antecedents of speech, maintaining that the idea to be expressed is not necessarily present in consciousness in advance of analysis and expression. What is present is a general intention. This arouses a series of verbal associates, which are accepted or rejected according as the fresh connotations which they bring with them are felt to harmonize with the original intention.

The speed of the associative process in comparison with the speed of articulation is measured by Hollingworth (7) who shows that in the color-naming test and in the opposites test, the individual differences are only in small measure due to differences in rapidity of articulation. His women subjects, by the way, were clearly superior to the men in facility of speech.

A monument of patience and prodigious industry in amassing data is Givler's (6) investigation of the esthetic effects produced by the speech elements in poetry. A preliminary statistical determination of the relative frequency with which the various sounds

occur in each of the leading English poets from Sydney to Rossetti, revealed characteristic differences and led to psycho-physiological experiments aimed to measure the dynamic effect and the affective quality of these speech elements when combined in simple relations. The subject spoke prepared iambics of meaningless sounds and simultaneously beat the rhythm with his free-moving finger. The rate and extent of the finger movement, graphically recorded, furnished an index of the dynamogenic effects of the speech elements used. Introspective reports were gathered regarding the accompanying affective consciousness. Transmutations of the sounds in actual lines of poetry representative of the different poets, were used in a similar manner. The results are far from clear-cut and definite, as must be expected in the search for so elusive a factor in poetic beauty. They are, however, of a nature to support the author's insistence on a rehabilitation of the tonal theory of poetry.

The last article to which reference is made is written not by a scientist but by a woman who while achieving distinction as an actress has also thought about the psychology of her art. Henrietta Crosman (3) records her theory of voice control, illustrates the significance of pitch, loudness and duration, and describes one of the associative mechanisms which she has found useful as an aid in commanding a desired quality of the voice. To simulate an emotion she thinks of its color: deep red for passion or power; lavender for gentleness; bright yellow or gold for wit; gray for sordid feeling; sky blue for restlessness, and sea blue for repose.

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## GRAPHIC FUNCTIONS

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The handwriting investigations of the past two years have emphasized, largely, two interests: (1) the utilization of writing as a material for testing various mental functions; and (2) the extension of methods for measuring proficiency in handwriting.

An experiment designed to test the conditions under which automatic writing occurs is reported by Downey and Anderson (6). Several methods were employed to produce automatic writing, such as writing a memorized verse while reading silently and aloud or doing sums in mental arithmetic; writing to dictation while reading aloud or answering questions under the same conditions. When simultaneous processes were run a careful record was made of the rapidity of each process and this speed compared with the speed under normal conditions. Complete introspective reports were obtained. The time records show a close approximation in certain instances to the normal speeded rapidity of each of the simultaneous processes. Usually, however, the retardation in writing speed was just about that which would cover the mental vocalization of the words written. From the introspective side material was gathered concerning lapses of awareness. The progressive failures in memory as the reagents learned with practice to concentrate upon reading; the fact that just about as much could be recalled at the close of a one- as at the close of a three-minute writing interval in the dictation experiment; the gradual loss of meaning, no doubt through breaks in connection; the more evident failures of memory when the reagents were in bad physical condition, led to the conclusion that all lapses reported were memory lapses which approached as a limit a completely dissociated mental bit. This experiment emphasizes the need of checking reports on automatic writing, since, obviously, lapses of memory may introduce a wide margin of error in report as to actual lapse of consciousness. With subjects unpractised in introspection this source of error would be very significant. Martin (14) reports a couple of cases in which automatic writing was used in investigation of the subconscious, a method found usable, however, with only two out of nineteen subjects tested. Martin also stresses the importance of drawing conclusions relative to automatic writing from reports of normal subjects, who are trained in introspection.

In connection with a report upon a case of spontaneous *right-hand* mirror-writing, Downey (4) raises several questions as to the validity of certain traditional views with respect to mirror-writing. Spatial reversals of several sorts are found by Stern to be common occurrences in the early drawings and script of right-handed as well as of left-handed children, due, according to Stern's interpretation, to the relative independence of form and position in the development of the child. The fusion of position and form would seem, in part, dependent upon a growth factor, one aspect of which might be a sensitiveness to spatial relationships from the standpoint of practical social orientation. In support of this view the present report shows some evidence of a valid coefficient of inverse correlation between age and ability to read mirror-script. Correlational coefficients point also to a close relationship of ability to read and to write mirror-script and to read and write inverted script. Furthermore, there is some evidence that ability to handle either mirror-reading or mirror-writing is correlated with degree of uni-dexterity. The traditional view that mirror-writing is the normal writing of the left-handed as left-handed needs revision.

In an attempt to carry further the determination of the relation of form and position in handwriting interpretation, Downey and Anderson (7) found coefficients of correlation for tests on mirror-reading and tests on the reading of samples of illegible writing and tests on the rapid and accurate pairings of handwriting specimens, the so-called Osborn test. The results of the tests, which need standardization, were somewhat inconclusive. Little evidence was found of correlation of ability to read illegible writing and to read mirror-script. The matching of hands proved particularly instructive because of the wide range of individual variation in proficiency and differences in methods of procedure. Matching of written addresses and matching of single words threw into relief curious variations in performance. Dependence upon general impression seems to serve an unpractised reagent more satisfactorily in matching addresses; dependence upon detail-comparison serves him better in matching words. The handwriting experts recommend single word comparisons, but in scoring writing by the scale certain investigators recommend dependence upon general impression.

Thorndike (21) has also used the Osborn test in his investigation of "The Resemblance of Young Twins in Handwriting," in which reagents were asked to match by resemblance each of

seventy-two specimens obtained from one of a twin pair with a specimen among the seventy-two obtained from the second member of the twin pair. By such a method it would be possible to derive a scale for unintentional resemblance in specimens of handwriting, a scale which might be utilized in the study of questioned documents.

The general problem of the perception of likeness and difference in handwriting is one of practical importance to the handwriting expert. Downey (5) in a repetition of Hollingworth's experiment failed to confirm his conclusion, the greater consistency with which the likeness judgment was given in comparison with the difference judgment. Attention is called to several factors that complicate the situation and certain modifications of method are suggested.

Osborn (15, 16) recapitulates the causes of error in identification of handwriting. Of particular interest to the psychologist is his analysis of the errors that arise from incompetence in the observer. The most common source of error is the basing of opinions on "general appearance alone." In detection of forgery two important questions arise: To what extent a genuine writing may diverge from a certain type; and how far a skillful forgery may fail to embody characteristics of genuine writing. In court procedure where proof is based upon the presentation of delicate "visible" evidence, such as paper-stains, variations in ink color, erasures, photographs, proper illumination is absolutely essential.

Gommès (10) in summarizing the various lines of graphic research shows the importance of a detailed understanding of the mechanics of the organs of execution (muscles and joints) in connection with handwriting identification. The forger may imitate successfully height, spacing, flourishes—the whole appearance—and fail in the matter of pivotage, the raising of pen, the play of fingers. In addition, particularly for grapho-pathological diagnostic, one must study the function of nervous transmission. Cortical participation in writing as a voluntary act must also be recognized in the form of imaginal and sensation control.

A notable study of the evolution of the automatic writing of children has been made by Wyczoikowska (22), with recognition of five stages of development so distinctive as to make it possible to judge of the child's state of general development by the evolution of its spontaneous writing. In the child's spontaneous writing letters of various ancient and modern languages occur, a fact which points to the existence of a graphical faculty wherein the writing impulse is rooted. An organic basis for cultural writing must be recognized.



The pedagogical interest in handwriting is still centered in the problem of the best methods of scoring. Two tendencies are noticeable: first, the further extension and critical application of the current writing scales and, secondly, an attempt to devise new methods for measurement.

The Ayres (1) scale for measuring the quality of handwriting of children has been utilized in determining a similar scale for adult writing, at request of the New York Municipal Civil Service Commission, with directions as to best methods for scoring samples.

The relation between the Thorndike and Ayres Scales is raised by several investigations. Pintner (17) finds that the Thorndike scale gives more uniform results and is more reliable than the Ayres, due, Pintner thinks, to the fact that it has taken into account other factors besides that of legibility. Most reagents express, however, a preference for the Ayres scale, perhaps because of its convenient form.

Starch (20) in scoring form and speed of writing gives directions for obtaining the latter and measures the former by either the Thorndike or the Ayres scale. He finds that convenience and accuracy of making measurements with either scale are practically the same. Equivalent values are given so that readings on the one scale may be changed into the other. One step on the Thorndike scale is equal to 8.9 on the Ayres. Starch measured the speed and quality of writing for 18 Wisconsin schools and computed a tentative standard score of efficiency for each grade. From these standards the efficiency of a given pupil, grade or school can be estimated very simply. An enormous overlapping in efficiency for the several grades is reported.

Another attempt to establish standards in handwriting for every grade is given in the investigation by Breed and Culp (2) of the writing efficiency in fifteen Michigan schools, as determined by speed and legibility of writing. These investigators question the assumption that the Ayres Scale measures legibility. By actual tests they find the coefficient of correlation between the Ayres Scale values and real legibility values varies from .30 to .38, probable error .06. "Correlation of .79, probable error, .03, and .84, probable error .02, were found between Ayres Scale values and Freeman form values, tending to confirm the view that the Ayres scale measures form rather than legibility." These investigators think that the relation between form and legibility should be determined.

Gray (11) has experimented upon the subjective factor in the

use of writing scales. Specifically, he sought to determine the effect of practice upon variability in grading, the practice running through twenty weeks. Some valuable suggestions are given with regard to the technique that should be observed in carrying out this training. With practice in scoring, there resulted greater uniformity among the judges, an outcome with which we are familiar from other investigations on the subjective judgment. A dependence upon general impression in contrast to detail comparison developed with practice, and, also, the acquirement of a general memory of the divisions of the scale. As a practical conclusion Gray urges the need of training a corps of teachers who shall take over the work of scoring handwriting.

In contrast to the stress laid upon dependence upon general impression in scoring writing by the scales, is Gray's (12) insistence upon the value of detailed analysis in diagnosis of difficulties in a specific sample of writing. Gray proposes measuring writing by the score card method as developed by agriculturists. Such a method involves determination of the elements to be measured and evaluation of these points so that the sum of values shall be equal to one hundred. The analysis of handwriting involved in such selection and weighting of graphic elements is valuable in itself and not attempted by the handwriting scales in present use. For practical purposes writing must be graded as a product, not a process, and the number of elements selected for grading must not be unduly large; they should, moreover, be mutually exclusive. The following list was selected: Spacing of letters, spacing of lines, spacing of words, slant, size, alignment, neatness, heaviness, formation of letters. In weighting these elements two methods were used, the Thorndike method and the regression equation. By this means the score card was developed. The score card method of measuring writing will no doubt contribute to analysis of handwriting of school children.

In connection with his valuable résumé of the psychology, physiology, hygiene, and pedagogy of handwriting, Freeman (9) presents a simple method for measuring the main graphic qualities, such as speed, uniformity of slant and of alignment, line-quality, letter-formation, and spacing. As far as possible these measurements are made objectively and there is less dependence upon subjective judgment than is the case in the employment of the current handwriting scales.

An experimental analysis of the graphic movements of adults and

children is also furnished by Freeman (8). Measurements of the size, speed and pressure of writing were obtained. Certain psychological factors in the development of the writing process were thrown into prominence by the analysis; for instance, the writing-rhythm, which was found to be more pronounced in the writing of adults than in the writing of children. "The component elements in the process come to be treated not as individual strokes or movements, but rather as stages in the process of the organized whole." The writing of the child is less rhythmical, less organized, and less automatized than that of the adult.

Drawing-scales, as well as writing-scales, are being extended. Rugg (19) reports a scale for measuring free-hand drawing. Childs (3) employed the Thorndike drawing-scale for the purpose of determining (1) growth in ability from grade to grade; (2) standards of ability for each grade; (3) limitations of the scale in actual use, and (4) administrative problems desirable for supervising authorities to know. Among other interesting results, it was found that smoothness of the curve and a marked rise at its end, greater range in gain during the eight years and a smaller range in variation of the product of each grade occurred in the school system with a drawing supervisor. It was found, however, that the average child develops more ability in drawing before entering school than in the entire eight years of his elementary school course. A plateau of non-development from the ages of nine or ten on to adolescence was found and confirmed the reports of earlier studies on children's drawings.

Lutz's (13) series of diagrams by means of which one advances from general outlines to finished pictures would certainly furnish entertainment to the child and would no doubt train him somewhat in selection of form and analysis of objects. A most valuable and detailed account of the aims and methods of teaching drawing is given by Polak and Quilter (18). The training afforded by the work outlined herein would be most profitable.

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## READING

BY E. H. CAMERON

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Much of the recent work relating to reading centers around the measurement of reading efficiency. Starch (7) gives a series of graded materials for such tests and presents standard scores in speed and comprehension obtained from over 3500 pupils. Mead (6) made tests on school children showing that they read more rapidly silently than orally and that in general more of the thought

can be reproduced by silent reading. Judd (3) found that in general rapid reading and comprehension go together.

One of the best of the more strictly pedagogical books on reading is that of Klapper (4). The author gives a simple and clear exposition of the psychology of reading, and a valuable analysis both of the basic methods and of the more recently evolved specific methods.

Downey (1) presents a report of an interesting case of spontaneous right-hand mirror-writing acquired in childhood, to which the subject tends to revert under certain conditions such as fatigue. Comparison of this person's skill in reading mirror script with that of several other college students revealed great individual differences in respect to this capacity, some of these subjects being superior to the original subject. Downey conjectures that capacity to interpret mirror reversals is dependent on dominant visual as opposed to motor tendencies in mental imagery. It was found that skill with the right hand in mirror writing correlates more highly with ability to read mirror script than does skill with the left hand. In a later study Downey and Anderson (2) found no correlation between ability to decipher and recognize illegible writing and either the pairing of hands or ability to read mirror script. A probable explanation is the relatively greater importance of the meaning factor in the former function.

In view of the relation between the development of language and pictorial representation MacDougall's (5) article is of special interest. An analysis is made of the function of illustration in connection with reading material, and the changing value of the picture in the life of the child and adult, corresponding to that which has already taken place in the race. On the whole there is a surfeit of pictures under conditions of modern society at exactly those points where they are least needed with a consequent loss in intellectual fiber.

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## SPECIAL REVIEWS

*The "Conscious Cross-Section": A Realistic Psychology.* R. C. GIVLER. Department of Printing, University of Washington. 1915. Pp. vi+412.

The author calls his book "a realistic program for psychology," and the interest of it is in the realism as well as in the psychology. The epistemological motive is never in abeyance. The epistemology is in all important points that of Holt in *The Concept of Consciousness*. The data of general psychology are competently outlined, and interpreted as "neutral" facts, of process and of content, which "exist together and arouse impulses in a way that is not found elsewhere" than in this organization of them which is consciousness, an exhibition of the "with-for" relation. Perry's "Realistic theory of Independence" and Spaulding's "Defense of Analysis," from *The New Realism*, are laid under important contribution, as well as Holt's book already mentioned.

An introductory announcement of the nature of the undertaking contains the following: "I am convinced that no pussy-foot departures from [the faculty-psychology—"memories of Aristotle, together with the latest popular information about the nerves"] will render adequate service to the matter involved." "Mind is [here] treated as something observable, something mentionable in all of its phases, as well as in its last analysis." "If logical treatment cannot be employed in psychology, we had better not talk of a science of human consciousness."

The book is not, however, a behavioristic psychology. "As I understand it, behaviorism is a theory of the criteria of mind, and not a system that can be substituted for psychology. . . . This book is a realistic program for psychology, and thereby holds that the environment is always to be kept in view along with whatever the organism may be internally or externally accomplishing upon it. . . . The empirical status of mind is the central item of this book, as well as the continual warnings against mysticism and sentimentality in regard to the science of psychology."

Agreeably with Holt's exposition of the nature of deductiveness and of the active functioning of propositions, mathematics is distinguished from the other sciences as the only science purely deductive;

but the deductiveness of it is nothing but functional interdependence among its principles. And it is just such *functional dependence* (which is now to displace the mythological notion of *cause*) that gives genuine deductiveness to the empirical sciences, among which psychology stands at the farthest remove from mathematics. Functional dependence in nature is to be understood to mean "(1) that all natural laws are laws of description and not of necessity, and (2) that those laws are exhibited only when terms are free to be involved in the relations they entail." "Things that stand in a functionally dependent relationship need have nothing in common."

Consciousness is defined as "the objects within responsive range of the nervous system, and the manner in which they are responded to by the nervous system." A science which treats of this matter is statable only in the same way as any other science, namely by the use of terms in relation, relations as well as terms being neither mental nor physical, but "the very tissue of the organization of the cosmos." "The significant differences in the universe are relational, not substantial, and not 'mental,' either." "'Spirit-stuff' is as relational as 'matter,' and when one analyzes even 'souls,' one finds no hidden, mysterious thing there at all."

With the third chapter the systematic analysis of consciousness begins: first of sensations and perceptions, then of responses and meanings, including speech. "This is the program: First to analyse objects from the standpoint of their being sensed, and then to analyse the physiological sensing process. . . . From the first standpoint it will be seen that there are two kinds of properties or attributes which give the sensation its thinghood: essential and inessential. . . . Every one of the essential properties at least will be furthermore seen to be a *series*, and the sensation a cross-section of those terms of each such series which, while the sensing process is going on, are contingent in time and space." The present analysis finds seven "essential" and eleven "inessential" attributes of sensation. "These eighteen attributes are the stuff of which sensation is made." The psychological "stimulus" is the physical "object." The sensation is more: the object and "what it will do."

Motor responses to disordered situations are the matter of Chapter IV, "The Emotional Complex." Such responses are the emotions, instincts, feelings, interest, purpose and the creative faculties. "Their stimuli are objects consisting of series, many of whose terms are missing. Thus mal-adjustment of the organism, and a disordered object are the functional and content sides of emotions and instincts" and their derivatives.

The last chapter, "Matters and Minds," is a "brief but wide study of the ramifications of psychology throughout our practical, daily life." "Objects sensed, objects perceived, objects in an emotional complication—these are the three chief disposals we make of the various series which meet one another to form quotidian things. The various series which get thus concatenated are the ultimate, neutral entities of the universe. When they are considered as being material for responses, they are called matters, and when they are being responded to, and thus united in the with-for relation, they are called minds. In other words, minds are what human bodies do with matters. Matters include minds, but if human beings are to speak in certain ways, the two expressions are required out of convenience and logic."

"That which disturbs our perceptions is the emotional complex, and the first thing to do, if one is to have perceptions of order and motor responses of permanence, is to get rid of all the complexes he can." "The word 'soul' . . . is a word which should be meant to imply a minimum of emotional complexes and a maximum of clear perceptual and motor furtherances." "The permanence of the idea, and its focality in mind is unwavering during the time that the individual is functioning and furthering it. I should call such an idea the source of personality, and I should say also that the mind furthering it was just as permanent as that interest which he was developing was permanent."

The unusual extent of quotation which has been made seems the fairest way to indicate the fertile suggestiveness of this interesting book. And it is thoroughly proficient technically. As for the important controversial matters of epistemology, there is nothing here which pretends to vary in any important way from the doctrine of Holt, which the author calls "the foundation upon which this whole structure has been laid."

The book is sometimes harder reading than it need be. The author carries informality, or non-conformity, of mere diction, so far that he sometimes loses clearness where more accustomed, though less piquant, wording would save it. The wording is often genuinely droll, and would be wholly enjoyable if comprehensibleness were not the first consideration.

For pedagogical purposes, the mechanical arrangement, matters of division and heading, could be improved. For a text-book, the division of almost the entire expository psychological material of the work into two chapters is odd and inconvenient.

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*Zur Analyse der Gedächtnistätigkeit und des Vorstellungsverlaufes.*

G. E. MÜLLER. *Zsch. f. Psychol.*, 1911, *Ergänzungsband* 5, pp. xiv+403; 1913, *Ergänzungsband* 8, pp. viii+567.

These two volumes contain a discussion of the general problems of memory and thinking. The discussion is based largely upon a detailed investigation of a supra-normal memory;<sup>1</sup> but the author also draws upon the results obtained in numerous memorial investigations upon which he has been engaged since 1887, and he cites from the findings of other investigators in this field.

The first volume opens with a consideration of types of sense-memory, and here the author presents a description of motor learning, visual learning, and learning by the blind; this section also discusses the circumstance that the procedure which an individual employs in any given act of learning, and in his subsequent recall, is determined by a multiplicity of factors. Among the factors which the author describes here are the individual endowment of the learner, the mode of presentation of the material, the rapidity of presentation, the characteristics of the material itself, the length of interval between learning and recall, fatigue and distractions. Then follows a discussion of the introspective method as employed in the investigation of memory and thinking. The author makes a sharp distinction between genuine and alleged introspection, that is, between the retrospective description of a mental process which has just completed its course, and the reminiscent or "anecdotal" method which has sometimes been appealed to as a substitute for the genuine introspective method. In consequence of his experience of nearly thirty years Müller concludes that retrospective description under controlled conditions does not differ essentially, either as to mental processes involved or as to trustworthiness, from the method of objective description as practiced in the physical sciences. He formulates a set of rules for guidance in introspecting, and appends a discussion of the controlling of the introspective method. In another section the author describes the methods employed and the results obtained in his investigation of Rückle's processes of learning and recalling. The materials employed were usually lists of num-

<sup>1</sup> Dr. Rückle was a student in mathematics at the University of Göttingen. He displayed remarkable skill in memorizing numbers and in calculating mentally; the feats which he is able to perform are much more marvelous than those of any other 'mathematical prodigy' who has ever been investigated. In addition to this Dr. Rückle has been a serious student of higher mathematics, and his doctorate thesis has been commended by mathematicians. Reports of Rückle's memory have already been published elsewhere from time to time; see this BULLETIN, 1913, 10, p. 337.

bers; but lists of consonants, Roman numerals, nonsense-syllables, poetry, geometrical figures and colors were presented in certain experiments. These materials were presented in a variety of ways; and the learning-effect was tested by a number of traditional methods. The results of these experiments enable the author to compare Rückle's memorial efficiency with that of other "prodigies," and to compare his learning of numbers with his learning of other materials; they also throw light upon Rückle's learning type, his employment of the principle of grouping the materials to be learned, and his use of memorial aids. It turns out that Rückle is dominantly visual but that he frequently has recourse to auditory-motor imagery; he differs from other "prodigies" not only in the fact that his memory of numbers is very much superior to theirs, but also in the fact that he possesses a supra-normal memory for other than numerical materials, and his general intellectual endowment is of a much higher order. His remarkable achievements are due in the main to an unusual capacity to concentrate his attention and to apprehend materials with extraordinary rapidity; his associations are exceedingly tenacious and his perseverations are almost negligible. Experience has taught him to adopt an economical procedure in learning; he always seeks to group his materials as advantageously as possible, and to seize upon such interrelations as obtain between the different parts of the material; his knowledge of mathematics and his remarkable memory for numbers enable him to discover relationships which escape the notice of the ordinary learner.

Müller's third volume is devoted to a consideration of certain of the more general problems of remembering and thinking. Among the most valuable portions of this volume, in the opinion of the reviewer, are the description of the component processes and the consecutive stages of the act of learning, and the discussion of the factors which contribute to subjective certainty in recall. An extensive consideration of *determinierende Tendenzen*, *Bewusstseinslagen*, *Bewusstheiten* and *Wissen* convinces the author that all of these phenomena can most readily be explained without having recourse to the hypotheses which have recently been brought forward by the Würzburg group. Perhaps the most ingenious and valuable part of the treatise is the discussion of indistinct imagery. Here the author advocates the view that this characteristic of indefiniteness is to be regarded not as a defect but rather as an advantage, in many instances at least; the indefinite image is capable of more



facile functioning, and in consequence of this advantage it serves a useful purpose in the economy of mind. The errors into which Ach, Binet, Watt and others have fallen are due to their failure to realize the presence and significance of indefinite imagery. Müller has repeated a number of those experiments whose results are alleged to support the doctrine of imageless thought, but his findings and his conclusions are completely at variance with those of the Würzburg group. He cites numerous introspections from the published papers of these writers and shows that there is no warrant for the interpretation which their authors have put upon them. Müller appends the caustic remark: "When one is unable to furnish any detailed information regarding a mental phenomenon one simply declares that it is a *Bewusstheit*. Of course, if this is what we mean by *Bewusstheiten* there is no lack of evidence that *Bewusstheiten* exist."

Müller's book is an exceedingly valuable contribution to the literature of psychology. Its author is undoubtedly the world's most experienced investigator in his field; and his systematic summary of the results and conclusions which he has reached in his thirty years of experimentation is sure to find a permanent place in the literature. His presentation is marred at times by an unfortunate tendency toward prolixity of statement; it is to be regretted, too, that the three volumes of the series were not published in consecutive order,<sup>2</sup> and that no index is supplied. The author shows a praiseworthy tendency throughout to base his discussions upon experimental findings; and his conclusions are conservative and well-founded. In these days when the literature of learning and thinking is encumbered by so many dilettante investigations and so many ill-founded speculations, it is refreshing to find a work that is dominantly empirical and conservative throughout. Müller's presentation of certain aspects of the psychology of learning is the best that has yet appeared; and his discussion of the psychology of thinking will undoubtedly contribute to a clearing up of the problems in this field.

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<sup>2</sup> The first volume (Sections 1-47) was published in 1911; the third volume (Sections 99-130) was published in 1913. The second volume (sections 48-98) has not yet appeared.

## NOTES AND NEWS

THE August number of the BULLETIN, dealing with comparative psychology, has been prepared under the editorial direction of Professor W. S. Hunter, of the University of Texas.

PROFESSOR W. S. HUNTER, of the University of Texas, has been appointed professor of psychology in the University of Kansas.

PROFESSOR L. R. GEISSLER, of the University of Georgia, has been appointed assistant professor of psychology and education in Clark College.

DR. A. S. EDWARDS, of the University of Minnesota, has been appointed professor of psychology and education at the University of Georgia, to succeed Professor Geissler.

DR. ELIZABETH L. WOODS has been promoted to assistant professor of psychology at Vassar College.

THE following item has been taken from the press:

A PSYCHOLOGICAL laboratory has recently been established at Bellevue Hospital under the direction of Dr. M. S. Gregory, the resident alienist. Research will be conducted by Dr. Leta S. Hollingworth, formerly psychologist in the Department of Public Charities in New York City.

